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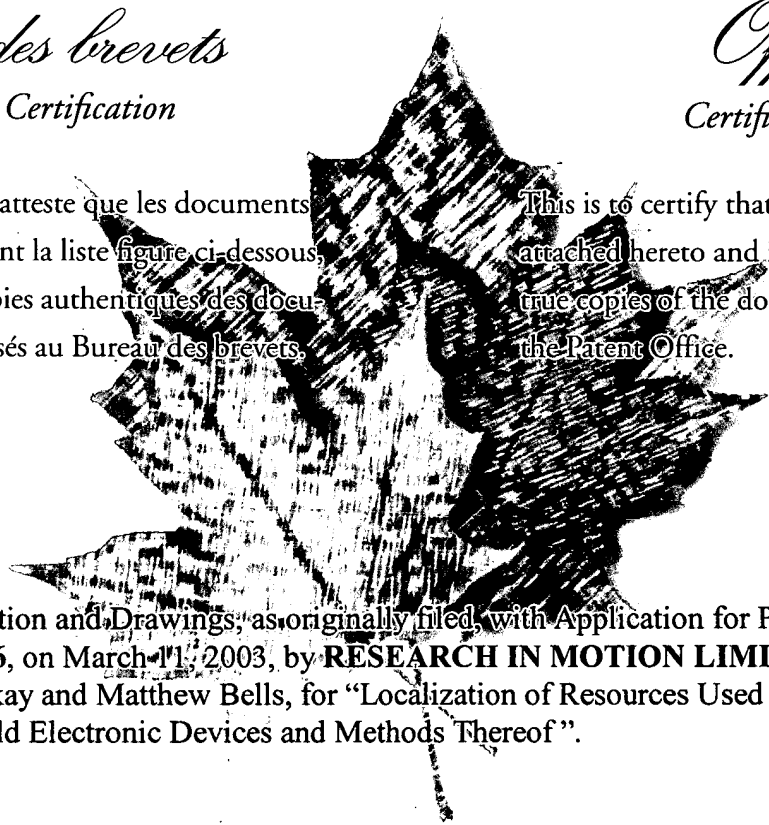
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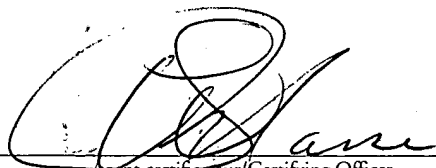
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Specification and Drawings, as originally filed, with Application for Patent Serial No:  
**2,421,656**, on March 11, 2003, by **RESEARCH IN MOTION LIMITED**, assignee of  
Jon Mackay and Matthew Bells, for "Localization of Resources Used by Applications in  
Hand-Held Electronic Devices and Methods Thereof".

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# **ABSTRACT**

[0042] Resource bundles may be downloaded dynamically over a wireless network to a hand-held electronic device so that applications on the device may support locale-specific user-interface resources.

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## **LOCALIZATION OF RESOURCES USED BY APPLICATIONS IN HAND-HELD ELECTRONIC DEVICES AND METHODS THEREOF**

### **BACKGROUND OF THE INVENTION**

5 [0001] A hand-held electronic device will have software applications installed on it. Localization for the software applications may be provided by way of resource bundles. However, since the hand-held electronic device has limited storage and memory, special considerations ought to be made with respect to the format, size, storage and downloading of the resource bundles.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

10

[0002] The subject matter regarded as the invention is particularly pointed out and distinctly claimed in the concluding portion of the specification. The invention, however, both as to organization and method of operation, together with objects, features and advantages thereof, may best be understood by reference to the following detailed description when read with the accompanied drawings in which:

15

[0003] FIGS. 1A and 1B are simplified diagrams of network communication systems;

[0004] FIG. 2 is a simplified flowchart of a method generate and store additional information relating to a string in an original language that is translated; and

20

[0005] FIG. 3 is a simplified flowchart of a method for determining whether a translated string is out of date.

25

[0006] It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

## DETAILED DESCRIPTION OF THE INVENTION

[0007] In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However it will be understood by those of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures and components have not been described in detail so as not to obscure the present invention.

[0008] FIGS. 1A and 1B are simplified diagrams of network communication systems. The system of FIG. 1A may comprise a hand-held electronic device 100, one or more origin servers 102, and an enterprise server 104. Hand-held electronic device 100 may be coupled to enterprise server 104 via a wireless network 106. Enterprise server 104 may be coupled to origin server 102 via a local-area-network or wide-area-network 108, such as, but not limited to, an Intranet or the Internet.

[0009] The system of FIG. 1B may comprise hand-held electronic device 100, one or more origin servers 102, and a gateway 105. Gateway 105 may be, for example, a direct Transmission Control Protocol (TCP) gateway or a Wireless Application Protocol (WAP) gateway, although the present invention is not limited in this respect. Hand-held electronic device 100 may be coupled to gateway 105 via a wireless network 106. Gateway 105 may be coupled to origin server 102 via a wide-area-network 108, such as, but not limited to, the Internet.

[0010] Hand-held electronic device 100 may be a personal data assistant (PDA), a personal information manager (PIM), a two-way pager, and the like. Hand-held electronic device 100 may have an operating system, a user-interface engine, and one or more specialized software applications, although the scope of the present invention is not limited to this particular architecture.

[0011] The software applications may have user-interface capabilities, implemented via the user-interface engine, which may be adaptable to specific locales. For example, the language of the user interface, and the formatting of numbers, data, currency and percents, may be locale-specific. In another example, the upper and lower casing of letters may be

locale-specific. In a further example, the way a list is sorted, or which day is the one in the left column of a calendar may be locale-specific.

[0012] Resource bundles are a convenient way to provide locale-specific resources for use by a software application. Resource bundles may comprise, for example, translated strings, and formatting information. Resource bundles may also comprise any or all of images, string arrays, and lists of strings. For example, a list of strings may be defined as follows:

**SAVE#0 = "Save";**

**CANCEL#0 = "Cancel";**

**DISCARD#0 = "Discard";**

10 while an exemplary array of strings may be defined as follows:

**CLOSE\_OPTIONS#0={**

**"Save",**

**"Cancel",**

**"Discard",**

15 **},**

[0013] When an application is installed on hand-held electronic device 100, a default resource bundle and possibly some other resource bundles may be installed along with it. However, due to the limited storage and memory of hand-held electronic device 100, generally not all available resource bundles are installed for all applications on the device.

20 [0014] An origin server 102 may store resource bundles for various applications and various locales. For example, each resource bundle may be located by a universal resource locator (URL) of the form:

**"protocol://address/ vendor/ product/version/locale.resource"**

[0015] For example, origin server 102 may store the following resource bundles:

25 **http://languages.rim.net / rim/ BlackBerryApps / 3.6.0 / en\_CA.rb**

**http://languages.rim.net / rim/ BlackBerryApps / 3.6.0 / fr\_CA.rb**

**http://languages.rim.net / rim/ BlackBerryApps / 3.6.0 / en\_US.rb**

**http://languages.rim.net / rim/ BlackBerryApps / 3.6.0 / es\_US.rb**

**http://languages.rim.net / rim/ BlackBerryBrowser / 3.6.0 / en\_CA.rb**

30 **http://languages.rim.net / rim/ BlackBerryBrowser / 3.6.0 / fr\_CA.rb**

`http://languages.rim.net/rim/BlackBerryBrowser/3.6.0/en_US.rb`

where, in this example, the protocol is "http" (although any other suitable protocol may be used), the address is "languages.rim.net", which is an example of the address of origin server 102, the vendor is "rim", the version is "3.6.0", and the locales are, in this example,  
5 as specified by Java convention. Resource bundles from different vendors may be stored on the same server.

[0016] The resource bundles may take any suitable form. For example, the resource bundles may be in the form of an uncompressed text file, or in the form of a compressed binary object, where any suitable compression algorithm or algorithms have been applied.

10 Clearly compressed resource bundles will require less download time for a given bandwidth than uncompressed resource bundles.

[0017] Each application for which locale-specific resource bundles are stored may contain a configuration string that indicates where the resource bundles may be found. For example, resource bundles for third-party applications may be stored on a server operated  
15 by the third party or, as described above, on a server along with applications from other parties.

[0018] In the event that a user of hand-held electronic device 100 wants to operate a particular application in a locale-specific manner for a particular locale, and the appropriate resource bundle is not currently installed on the device, the user may instruct hand-held  
20 electronic device 100 to download the desired resource bundle over wireless network 106. In some embodiments, the user may select a particular locale, and hand-held electronic device 100 will automatically download resource bundles for that locale for each application installed on device 100, if available. In some embodiments, the user may view all available resource bundles by having device 100 access the URL "protocol://address/",  
25 or all available resource bundles for a particular application by having device 100 access the URL "protocol://address/vendor/product", or all available resource bundles for a particular version of a particular application, by having device 100 access the URL "protocol://address/vendor/product/version".

[0019] Similarly, fonts to properly display the language (e.g. currency symbols) or other locale-specific resources used in a resource bundle may be downloaded by device 100 over wireless network 106 from a server.

[0020] It is anticipated that the ability to selectively and dynamically download resource bundles for applications over a wireless network will serve many purposes. For example, a user habitually resident in Canada may travel to Switzerland for a short business trip, taking her hand-held electronic device along with her. Resource bundles for the locales en\_CA and/or fr\_CA may already be stored on the device, with one of the resource bundles serving as the default. While in Switzerland, she may wish to enable a German speaker to use the hand-held electronic device. She may download the resource bundles for the locale de\_CH, corresponding to the German language in Switzerland, for one or more applications installed on the device. The resource bundles will be downloaded over a wireless network, so that the user is not required to download the resource bundles to a computer and then sync the hand-held electronic device to the computer. Once her business trip is completed, the user may delete the resource bundles for the locale de\_CH from her device in order to free up storage and memory of the device.

[0021] Resource bundles may be grouped into families according to their application. If a resource bundle family for a particular application is installed on hand-held electronic device 100, then the application may switch languages without requiring new resource bundles. This may be implemented, for example, by having the application make reference to its resource bundle family, and access the appropriate reference bundle from within the family on-the-fly by a reference to the current locale selected by the user. For example, user-interface components of an application may accept as a localized String pairs comprising an identifier of the resource bundle family and an identifier of the string to be accessed. The string will be resolved within the user-interface component in a locale-specific manner according to the current locale. Applications need not listen for a change-locale event. Rather, as described above, the application makes reference to the current locale. Consequently, when the locale changes, the application will start displaying information in a manner appropriate to the new locale, without having the application restart.

[0022] Hand-held electronic device 100 may store resource bundles or a resource bundle family comprising locale-specific translations of common user-interface resources, for example, translations of common strings such as "Open", "Close", "OK", "Cancel", etc. When the current locale of hand-held device 100 is not supported by an application  
5 installed on the device, any occurrences of common user-interface resources in the application may be replaced automatically by the translations in the appropriate resource bundle. Consequently, at least a portion of the user-interface resources of the application will appear in the appropriate language for the current locale.

[0023] Java encodes a locale as an object with 3 strings. This consumes at least 132 bytes  
10 of storage and may result in slow comparisons. In contrast, in some embodiments of the present invention, the language and country of a locale are encoded together as a 4-byte integer. The variant may be encoded as a 4-byte integer as well, so that a single locale requires no more storage than 8 bytes. Consequently, comparisons may be performed by an *int* or *long* comparison instruction of a processor of hand-held electronic device 100.

15 Moreover, mapping each byte onto an ASCII value may enhance debugging.

[0024] Hand-held electronic device 100 may also comprise an autotext engine, which is a software application that extends the user interface and makes use of one or more databases to perform text insertions and other related activities. In addition to a standard autotext database comprising entries of "original string" and associated "replacement strings" pairs,  
20 an additional database comprising locale-specific entries could be stored on hand-held electronic device 100. A user of hand-held electronic device 100 may subscribe to a number of databases whose changes could be pushed to the device over wireless network 106.

[0025] For example, a health professional may subscribe to a database whose entries  
25 include, for example, some or all of the following pairs: ("cpe", "complete physical examination"); ("bp", "blood pressure"); ("cv", "cardiovascular"); ("fh", "family history"); ("infln", "inflammation"); etc. In another example, a legal professional may subscribe to a database whose entries include, for example, some or all of the following pairs: ("cpas", "contract of purchase and sale"); ("def", "defendant"); ("pla", "plaintiff"); ("sol",  
30 "solicitor"); ("priv", "privileged"); etc. Similarly, a company whose employees use hand-



held electronic devices such as hand-held electronic device 100 may provide a database to employees whose entries include shortcuts of terminology related to the company's business. Changes to the company-specific database could be pushed to the devices over wireless network 106. For example, a database for Research In Motion employees may include some or all of the following pairs: ("bb", "BlackBerry"); ("cdma", "CDMA"); ("rim", "RIM"); ("rimo", "Research In Motion"); etc.

[0026] Since a locale indicates not only a country and a language, but also a variant, a locale may be used to indicate the profession or industry or company to which the user belongs, thus identifying which databases are of interest, although the present invention is not limited in this respect.

[0027] The autotext engine, or alternatively a separate software application, may be able to implement an AutoArticle functionality. The user of hand-held electronic device 100 may enter a special character sequence (defined on a per-language basis) that triggers a dictionary and/or grammar lookup to determine whether a word of interest is masculine, feminine, plural, etc. This feature may be useful, for example, in a language such as French, Italian, or Danish.

[0028] In an auto-correct mode, articles may be inserted or corrected automatically as they are entered by the user. The user may use a special character sequence (defined on a per-language basis) to indicate that the article should be automatically inserted. For example, "Il lune" would become "la lune" while "Il soleil" would become "le soleil". "Il bureaux" would become "les bureaux", and "uu bureau" would become "un bureau". Alternatively, instead of having the user enter a special character sequence, in auto-correct mode an incorrect article would be automatically corrected. For example, "le lune" would be automatically corrected to "la lune". If the autotext engine were unable to determine the article of a word, a dialog may appear to enable the user to choose the article to use.

[0029] The autotext engine, or alternatively a separate software application, may be able to implement an AutoQuote functionality. For example, a user of hand-held electronic device 100 may enter a quote character. If the quote character is preceded by an empty or whitespace, then the quote character would be replaced with an open-quote character. Otherwise, the quote character would be replaced with a close-quote character. The open-

quote character and close-quote character may be locale-specific. For example, when the current locale of hand-held electronic device 100 includes the French language, the open- and close-quote characters may be guillemets (« and », respectively). In another example, when the current locale hand-held electronic device 100 includes the German language, the open- and close-quote characters may be guillemets, or else the open-quote character may be a lower quote („) and the close-quote character may be an upper quote (").

[0030] In order to facilitate the localization of applications developed for electronic devices, such as hand-held electronic device 100, certain features may be incorporated into a development environment. For example, to determine whether a translation is current, a file or database record comprising translations of strings from an original language may also include additional information related to the strings in the original language. This may be used, for example, to track multiple versions of resource strings when working on a project where multiple versions are source control branched.

[0031] FIG. 2 is a simplified flowchart of a method to generate and store this additional information. One or more strings in an original language may be translated into a different language (200). A hash value may be generated for each string in the original language by using a hash code method (202). The hash value may be stored along with the translated string (204). As is known, the hash value for a particular input is statistically unique.

[0032] It may occur that during development of an application, a string in an original language is changed after having been translated. FIG. 3 is a simplified flowchart of a method to determine whether a translation is out of date. A hash value of the current string in the original language may be generated using the same hash code method of Fig. 2 (300). This newly generated hash value may be compared to the hash value stored with the translated string (302). If the hash values match, then in all likelihood, the string in the original language has not changed since the translation was done, and the translated string is current (304). If the hash values do not match, then the translated string is out of date (306). A viewer or editor application in the development environment may then visually indicate which information is current and which is not.

[0033] Another feature that may be incorporated into the development environment is to provide a resource bundle diagnostic tool. For example, a resource bundle may be defined

using at least two separate files: a resource header file, that lists keys for each localized resource in the resource bundle, and a resource content file, that lists the keys and their localized resource values. A resource bundle diagnostic tool may perform any or all of the following operations:

5 **I. Validation operations**

a) checking for missing resources, by identifying keys listed in the resource header file that have no corresponding entry in the corresponding resource content file;

b) checking for empty resources, by identifying keys listed in the resource header whose corresponding entry in the corresponding resource content file has no localized resource value defined;

c) checking for undeclared resources, by identifying resources listed in the resource content file but whose key has not been listed in the resource header file;

d) checking for out-of-date resources as described above;

e) verifying that the original resource value and the localized resource value have the same format, for example, "name: " has been translated to "nom: ", and the space after the colon has been included in the translated string;

f) checking that the display width of the resources (which may depend upon the widths of characters in a particular font) do not exceed the predefined display width of the screen of the hand-held electronic device;

g) validating hotkeys (used to quickly access different applications on the hand-held electronic device) to ensure that in a particular locale, the same hotkey is not assigned to more than one function, and to ensure that the hotkey is an allowed length;

**II. Statistical operations** – generating statistics for the number of new resources present, which may, for example, be used by the developer to gauge how much work still needs to be done; and

**III. Searching for unused resources** – identifying resources listed in the resource header file and resource content file, but not called by the application.

[0034] Software development is often tracked using a source code control system. As developers write software code, various branches are made for different releases to customers, so that developers can write new, untested code at the same time that a branch is

being tested and stabilized for release. Since different branches of software code may have many resources in common, it is generally not feasible for the resources of each branch to be translated separately.

[0035] Another feature that may be incorporated into the development environment is to have a resource "database" tool. For example, the tool may generate from resource files of a particular branch of code of a software application a resource "database". The "database", which may be a flat file or any other format for storing the information, may contain an identifier of a resource, for example, CLOSE#0, its value in various locales, for example, "Close" in the locale "en", "Ferme" in the locale "fr", the hash value of the resource value in its original language, as described hereinabove, and the name of the resource file(s) for these resources. In other embodiments, other information may be included in the "database", and/or not all of the above-listed information may be included in the "database".

[0036] The tool may enable a software developer or integrator to copy the resource "database" to another branch of code of the software application. If this other branch of the software application does not yet comprise localized resource files, the tool may then enable the creation of localized resource files comprising the resources whose information is stored in the copied resource "database". The validation tools described hereinabove may then be used to determine whether translations of resources appearing in this branch are up to date or missing. Only those localized resources which are missing or out of date will then be marked for translation, rather than requiring all the resources for this branch to be translated.

[0037] Alternatively, this branch of the software application may already comprise resource files, and the tool may use the copied resource "database" to update translated resources when the hash value in the copied resource "database" does not match the hash value in this branch's resource files, and to complete missing resource values in this branch's resource files. Only those localized resources which are still missing or still out of date will then be marked for translation, rather than requiring all the resources for this branch to be translated.

[0038] The format of resources in a resource bundle may enable strings to display one of a predefined set of string options by matching the options with attributes in a text. This type of format may have several uses, only one of which will be described here for clarity. Moreover, although only one type of format is shown in the following examples, alternate  
 5 formats that enable strings to display one of a predefined set of string options by matching the options with attributes in text may be used instead and are within the scope of the present invention.

[0039] For example, the format may be used to match gender. The phrase "Repeats every {0}", where {0} is replaced with either "week" or "month" will be translated in French to  
 10 "Répète toutes les semaines" or "Répète tous les mois". Depending on the gender of the insertion, the second word of the French phrase is different. For example, the translated phrase may use the following format:

"Répète {0,choiceattrib,m#tous|f#toutes} les {0}"

thus associating "tous" with the attribute "m" and "toutes" with the attribute "f", and the  
 15 insertions may be "semaines\0f" and "mois\0m", thus giving "semaines" the attribute "f" and giving "mois" the attribute "m". Then the user interface of the hand-held electronic device may be extended to test the insertions for the attribute and to select the string associated with the attribute of the insertion.

[0040] While certain features of the invention have been illustrated and described herein,  
 20 many modifications, substitutions, changes, and equivalents will now occur to those of ordinary skill in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

[0041] What is claimed is:

1. A method comprising:

5        downloading over a wireless network to a hand-held electronic device one or more files including localized resources for one or more applications installed on said hand-held electronic device.

2. The method of claim 1, wherein said one or more files include one or more fonts.

3. The method of claim 1, further comprising:

      downloading over said wireless network to said hand-held electronic device a list of said one or more files.

10    4. The method of claim 1, wherein said applications are from different vendors.

5. The method of claim 1, wherein at least one of said files includes localized resources for more than one locale.

6. A method comprising:

15        providing one or more files on a server or gateway for download over a wireless network to a hand-held electronic device, said files including localized resources for one or more applications and said hand-held electronic device having at least one of said one or more applications installed thereon.

7. The method of claim 6, wherein said files include one or more fonts.

8. The method of claim 6, wherein said applications are from different vendors.

20    9. The method of claim 6, wherein at least one of said files includes localized resources for more than one locale.

10. An article having a medium storing computer-readable code, that when executed by a computing platform, results in:

25        downloading over a wireless network to a hand-held electronic device one or more files including localized resources for one or more applications installed on said hand-held electronic device.

11. A method comprising:

grouping together on a hand-held electronic device having installed thereon an application localized resources of said application for more than one locale; and

5 accessing one of said localized resources by referring to a current locale, to said grouping and to a particular resource of said application.

12. An article having a medium storing computer-readable code, that when executed by a computing platform, results in:

10 accessing a localized resource of an application from a grouping of localized resources of said application for more than one locale by referring to a current locale, to said grouping and to an identifier of a particular resource of said application.

13. A method comprising:

storing localized versions of common resources for more than one locale on a hand-held device; and

15 in the event that a current locale is not supported by an application installed on said hand-held electronic device, automatically replacing occurrences of said common resources in said application with localized versions of said common resources for said current locale.

14. An article having a medium storing computer-readable code, that when executed by a computing platform, results in:

20 automatically replacing occurrences of common resources in an application installed on a hand-held electronic device that does not support a current locale with localized versions of said common resources retrieved from a set of localized versions of said common resources for more than one locale.

15. A method comprising:

25 encoding a language of a locale and a country of said locale together as a single 4-byte integer.

16. The method of claim 15, further comprising:

encoding a variant of said locale as another 4-byte integer.

17. The method of claim 15, further comprising:

using an integer-comparison instruction of a processor to compare said locale with another locale whose language and country are encoded as 4-byte integers.

18. A method comprising:

5 encoding a language of a locale, a country of said locale and a variant of said locale together as a single 8-byte long.

19. A method comprising:

10 pushing updates of an autotext database over a wireless network to a hand-held electronic device, wherein said autotext database includes industry-specific terminology.

20. A method in a hand-held electronic device having a current locale, the method comprising:

identifying a character sequence entered by a user of said hand-held electronic device as matching a predetermined sequence associated with said current locale;

15 determining an article that is grammatically correct in said current locale for a word entered by said user following said character sequence; and  
automatically replacing said character sequence with said article.

21. A method in a hand-held electronic device having a current locale, the method comprising:

20 determining that an article of a word is grammatically incorrect in said current locale, where a sequence of characters including said article and said word have been entered by a user of said hand-held electronic device; and

automatically replacing said article with an article of said word that is grammatically correct in said current locale.

25 22. A method in a hand-held electronic device, the method comprising:

when a first locale is a current locale of said hand-held electronic device, automatically replacing a quote character entered by a user of a hand-held electronic



device that is preceded by an empty or white space with a first open-quote character for said first locale; and

when a second locale different from said first locale is the current locale of said hand-held electronic device, automatically replacing a quote character entered by a user of said hand-held electronic device that is preceded by an empty or white space with a second open-quote character for said second locale that is different from said first open-quote character.

23. A method comprising:

generating a hash value for a string in an original language using a hash code, said string associated with a resource of a software application; and

storing said hash value and along with a translation of said string, said translation associated with said resource.

24. The method of claim 23, further comprising:

using said hash code, generating a new hash value for the string in said original language associated with said resource; and

comparing said new hash value to said stored hash value to determine whether said translation is up to date.

25. A method comprising:

analyzing at least two files including localized resource information for a software application for a hand-held electronic device to validate said localized resource information by checking for missing resources, empty resources and/or undeclared resources.

26. The method of claim 25, wherein analyzing said at least two files comprises checking for resources that need an updated translation.

27. The method of claim 25, wherein analyzing said at least two files comprises checking whether an original resource value and a corresponding localized resource value have the same format.

28. The method of claim 25, wherein analyzing said at least two files comprises checking whether a display width of a resource exceeds a predefined display width of a screen of said hand-held electronic device.

29. The method of claim 25, wherein analyzing said at least two files comprises checking whether in a particular locale, a hotkey is assigned to more than software application of said hand-held electronic device.

30. A method comprising:

generating from one or more files in a first branch of code of a software application for a hand-held electronic device a collection of information regarding localized resources of said first branch; and

copying said collection to a second branch of code of said software application.

31. The method of claim 30, further comprising:

generating in said second branch one or more files comprising localized resources for said second branch from said copied collection .

32. The method of claim 30, further comprising:

updating from said copied collection one or more files comprising localized resources for said second branch.

33. A method in a hand-held electronic device having a current locale, the method comprising:

preparing a string for display by said hand-held electronic device by:

identifying an attribute of text to be included into said string;

selecting one of a predefined set of string options according to said attribute; and

including said selected one of a predefined set of string options in said string for display.

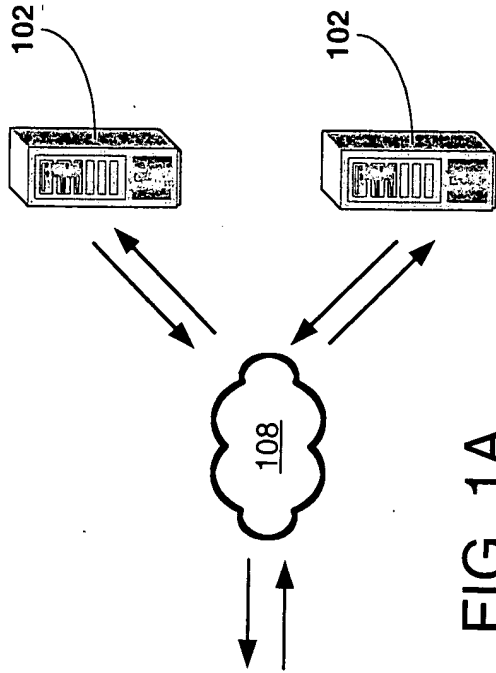


FIG. 1A

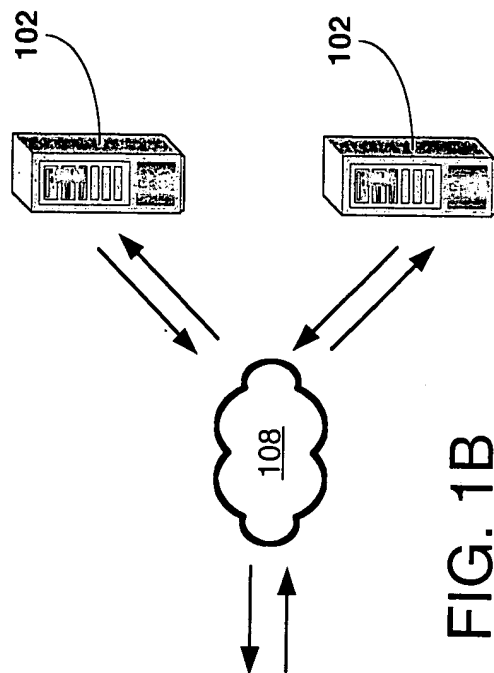


FIG. 1B

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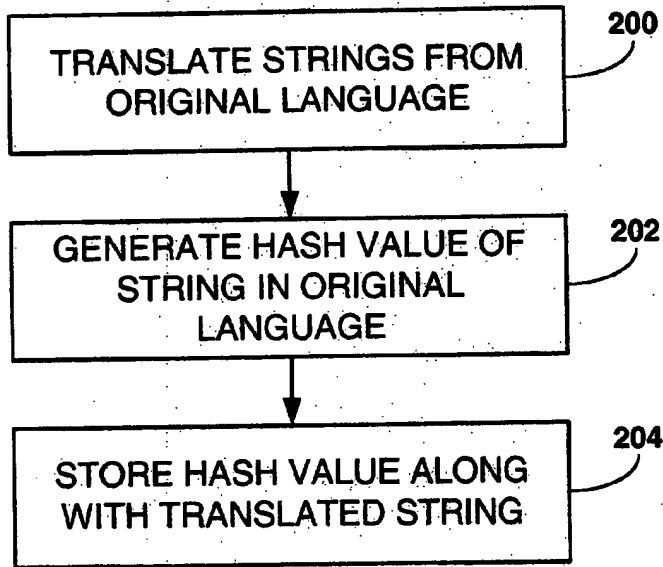


FIG. 2

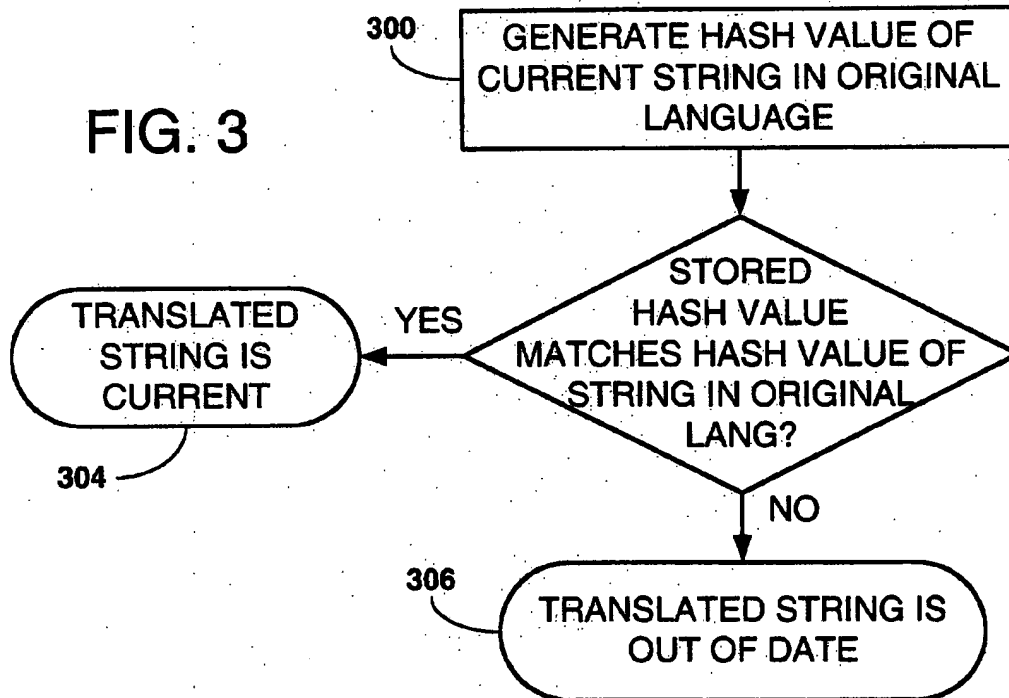


FIG. 3